125 Battery Makers

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Core Messages

- Rarely reported as cause of occupational skin problems
- Irritant contact dermatitis more common than allergic contact dermatitis
- Chemical burns may occur
- Common irritants include acid or alkaline electrolytes
- Personal protective equipment was most common reported cause of allergic contact dermatitis

1 Introduction

Batteries are of many different types, but they all produce an electric current via a circuit using a positive electrode, a negative electrode, and an electrolyte acting as an ionic conductor. If the electrolyte is liquid, the battery is called "wet" and if it is a powder or paste it is called "dry." Some batteries are rechargeable.

Most "wet" batteries are lead acid with grids or plates of lead and lead oxide acting as electrodes. During lead oxide manufacture, significant heat is generated when lead reacts with oxygen under controlled conditions. The grids have a paste of lead oxide and sulfuric acid applied. The paste may also contain additives such as barium sulfate, carbon black, and polyester fibers. The electrolyte is a solution of sulfuric acid. The plates may also have fiberglass sheet separating them. Fiberglass may additionally be used in battery casings and, occasionally, asphalt is used as a sealant. Flooded lead acid batteries have synthetic separators, for example, polyvinylchloride or polyethylene. There are also alkaline cell batteries, which are different by having a positive nickel oxide electrode, a negative iron electrode and the electrolyte is usually potassium hydroxide. The iron electrode is replaced by cadmium in the nickel/cadmium cell, and zinc powder is used as the anode and silver oxide as the cathode in a silver/zinc battery.

The traditional "dry" Leclanche battery has a negative electrode and casing of zinc, while the positive electrode is a carbon rod surrounded by a mixture of carbon and manganese dioxide. A mixed ammonium chloride and zinc chloride paste is the electrolyte. Button batteries are used in hearing aids and watches, etc., because of their small size. They often use zinc as the negative electrode and mercury oxide as the positive, with an alkaline electrolyte such as potassium hydroxide. Newer technology allows a zinc anode and atmospheric oxygen or silver oxide as the cathode material. Longer life has been achieved with a zinc anode and magnesium dioxide as the cathode and potassium hydroxide being used as the electrolyte (alkaline battery). Lithium/manganese dioxide batteries can also be used as small high-powered batteries. Lithium salts may be used as the electrolyte. Newer rechargeable batteries use a nickel salt as the positive electrode and a metal hydride as the negative electrode, with potassium hydroxide as the electrolyte.

2 Contact Irritants

Heat
Sulfuric acid
Zinc chloride
Potassium hydroxide
Sodium hydroxide
Fiberglass
Talc
Asphalt (also phototoxic and acnegenic)

3 Contact Allergens

Standard battery	Nickel sulfate, 5% petrolatum
	Potassium dichromate, 0.5% petrolatum
	Colophony (solder flux), 20% petrolatum
	2-Mercaptobenzothiazole, 2% petrolatum
	Mercapto Mix, 2% petrolatum
	Thiuram Mix, 1% petrolatum

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	N-Isopropyl-*N*-phenyl-4-phenylene diamine, 0.1% petrolatum
Additional allergens	Mercury, 1% petrolatum
	Mercuric chloride, 0.1% petrolatum
	Latex, as is
	Carba Mix, 3% petrolatum
	Hydrazine (flux), 1% petrolatum
	Coal tar (asphalt), 5% petrolatum

The main potential risk of dermatitis in battery makers is from a chemical burn, or irritant contact dermatitis from the acid or alkaline electrolytes. The finished fiberglass materials used in batteries are not usually a problem, but there is a possibility of an irritant dust being produced if they are ground or cut. Talc dust may act as an irritant when the lead castings are taken out of the moulds, where it is used as a release agent. Asphalt fumes are irritant and may induce photosensitivity and actinic damage (Adams 2000). Skin disorders may be exacerbated by the heat generated by furnaces used to melt down the ingots.

Apart from nickel and mercury, most electrode materials are unlikely to induce contact allergy. Welding and soldering activities represent a potential hazard for a contact allergy, from solder fluxes and chromate in welding rods. Rubber and leather protective clothing may induce contact allergy. It should be noted that rubber footwear will need to be worn in areas where there is a potential for electrolyte spillage on to the floor.

Reports of skin problems in this industry are few. Data available from the Health and Occupation Reporting Network (THOR) for a 7-year period (2002–2009), revealed only six reports of occupational skin diseases in battery manufacturers or operatives reported by consultant dermatologists to EPIDERM, a voluntary reporting scheme for occupational skin diseases by consultant dermatologists and four cases reported by occupational physicians to the Occupational Physicians Reporting Activity (OPRA). All cases were reported as contact dermatitis. Nine of the ten cases were related to the current occupation (one to previous occupation). Of the nine cases, three were allergic contact dermatitis (all due to rubber gloves), four cases of irritant contact dermatitis (acids – three and grindings), and two cases of mixed irritant and allergic contact dermatitis (acids causing irritation, contact allergy to formaldehyde releasers and rubber) (R Agius, personal communication).

The medical literature has sparse reports. Excessive environmental heat in Nigerian battery manufacturers induced sweating and maceration of the skin, especially over the anterior abdominal wall; this predisposed five individuals wearing dark-colored uniforms to clothing dermatitis. In the same report, one person working with bitumen developed an acneform skin eruption (Olumide et al. 1983).

References

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